

Polybenzoxazine Materials for Radiation Shielding, Phase II

Completed Technology Project (2015 - 2017)



Project Introduction

The proposed work will expand upon the Phase I efforts based on lightweight multifunctional composite materials with polybenzoxazine (PBz) matrices, with emphasis on high hydrogen content composites that provide excellent radiation shielding. The work focuses on material systems that provide multifunctional capabilities including strength, stiffness, and toughness. Phase I work demonstrated proof-of-concept for the novel benzoxazine resin based formulation and demonstrated its use in the fabrication of prototype polyethylene fiber composite. This approach provides a novel path to addressing NASA's need for lightweight shielding materials that can also serve as structural members and provide protection from micrometeoroid impact. Polybenzoxazines are organic thermosetting polymers that can be tailored at the molecular level to optimize characteristics that are particularly advantageous for radiation shielding applications, such as high hydrogen content. Polybenzoxazines are easily synthesized from inexpensive raw materials and can be optimized for high hydrogen content, high temperature performance, and/or high strength to weight ratio. Our approach to these multifunctional spacecraft materials continues refinement of the polybenzoxazine composite technology that was demonstrated in Phase I. Specific goals of the project include: a) optimization of composite processing and quality and determination of the process window; b) determination and benchmarking of mechanical properties; c) preparation of target samples for shielding testing; d) and scale-up of both the resin synthesis and composites manufacture.

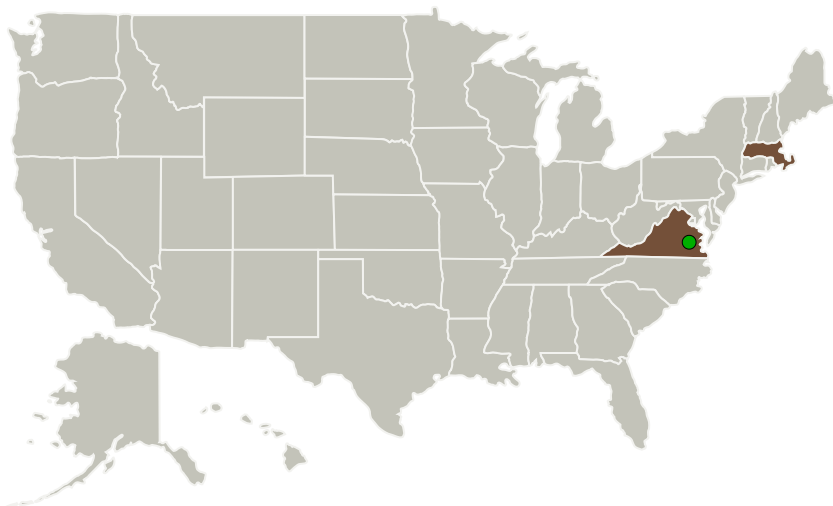


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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Primary U.S. Work Locations and Key Partners



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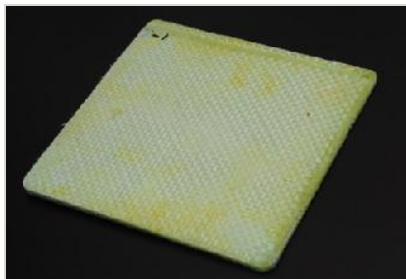
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Organizations Performing Work	Role	Type	Location
Material Answers LLC	Lead Organization	Industry	Weston, Massachusetts
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Massachusetts	Virginia

Images



Briefing Chart Image

Polybenzoxazine Materials for Radiation Shielding, Phase II
(<https://techport.nasa.gov/image/130628>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Material Answers LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Chris Scott

Co-Investigator:

Chris Scott

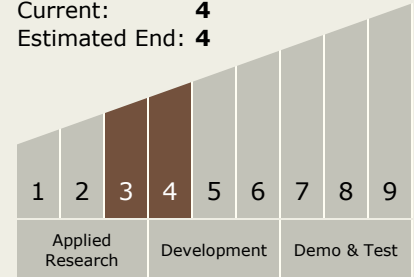
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Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.5 Radiation
 - └ TX06.5.3 Protection Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System